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Floodlighting

By R. O. ACKERLEY, M.I.E.E. *(Fellow)*

Summary

Floodlighting is defined as "the lighting, usually by projection, of the whole of a scene or object to a level considerably greater than that of its surroundings." The paper deals mainly with the application of floodlighting out of doors with particular reference to the spectacular floodlighting of buildings. Satisfactory floodlighting depends on effective light control and the equipment used must, therefore, be well designed optically so that the engineer can choose from a range of equipment a unit appropriate to any normal requirement of beam shape and length of throw. Floodlighting equipment has to operate in all weathers and often in relatively inaccessible positions. It must, therefore, be robust, watertight, capable of dissipating the heat from the lamps and easy to maintain. The application of such equipment in an installation involves consideration of factors which are as much artistic as physical. The determination of the direction from which the main floodlighting should be directed involves consideration of the angle from which the object is most likely to be viewed as well as the nature of any architectural features and the depth of shadow they will cast. It often involves compromise on account of the practical limitations imposed by the facilities available. Supplementary lighting can be used to emphasise special features, to introduce highlights or to fill in gaps in the main lighting caused by local obstructions. The level of illumination required depends upon a number of factors including the function of the building. Coloured light sources can sometimes be used with advantage.

After analysing a typical installation in some detail, possible fields of floodlighting are discussed in the paper including the lighting of gardens, fountains, etc., as well as more utilitarian industrial applications.

(1) Introduction

The term floodlighting has recently been defined by the British Standards Institution as "The lighting, usually by projection, of the whole of a scene or object to a level considerably greater than that of its surroundings." It is a term which is used by specialists in a number of different contexts, for example in the lighting of shop windows, theatre stages and cinema or photographic studios, but to the average layman and the non-specialist lighting engineer, the term, unqualified, usually implies the lighting of outdoor scenes, whether for spectacle—as when fine buildings or gardens form the subject—or for practical utility—as when floodlighting is applied for outdoor industrial purposes. It is these aspects of floodlighting that will be discussed in the following paper.

Floodlighting in this sense was in wide use prior to 1939, but since that date, due, firstly, to the war and subsequently to fuel restrictions, has been very little practised in this country. Consequently, a new generation of lighting engineers has grown up with no knowledge or experience of the techniques involved, while the older generation may well feel the need for a refresher after ten years lack of practice. The hope that the 1951 "Festival of Britain" may see the revival of floodlighting on a wide scale all over the country provides a special justification for this attempt to reassemble in connected form some of the knowledge gained in the pre-war years. No claim is

The author is a lighting consultant. Manuscript was first received on December 20, 1949, and in revised form March 17, 1950. The paper was presented at a meeting of the Society held in Buxton on May 17, 1950.

made that the contents of this paper are original or that any new light is being thrown on the subject by it.

Floodlighting for spectacle is essentially the practice of an art at least as much as a science, but an art which has hitherto mainly been practised by engineers. It is likely to continue to be so practised because its successful accomplishment depends upon the proper understanding of the medium, artificial light, with which the picture is painted; it depends, in other words, upon the science of lighting. In discussing the subject, therefore, the paper will be divided into two main parts, the first dealing with the underlying science and the second with those aspects of practical installation design where science and art mingle. A brief final section will review some of the potential fields for floodlighting.

(2) The Technical Problem

(2.1) Light Control

Returning to the definition of floodlighting given above, it is seen that the problem is "to light the whole of a scene or object to a level considerably greater than that of its surroundings." The scene or object may be very large—as, for example, Edinburgh Castle—or relatively small—such as a statue or a single tree—but the essence is that the light must be concentrated on a defined area and must not spill over on to the surroundings. The first requirement, therefore, is accurate control of the distribution of light from the floodlights. Objects vary tremendously in shape as well as size, and it is economically impracticable to have floodlights specially designed for every job. The usual procedure, therefore, is to have a limited range of equipment with which a build-up of light can be made to fit any required area.

The key to the floodlight distribution is the reflector. It may give a beam of wide or narrow spread, symmetric or asymmetric. In general, symmetric beam floods are satisfactory for long throws, while for close-up work asymmetric distribution is preferable. For example, when floodlights are placed close to a building face, a fan of light such as comes from an asymmetric beam giving a very narrow distribution in one plane and a very wide one in a plane at right angles, is essential unless floods are to be placed at extremely close intervals.

The beam distribution from a given reflector can be modified in a number of ways. A change of lamp from a general-service lamp to a projector lamp will generally have the effect of narrowing and concentrating the beam. Thus the Class B2 projector lamp which, excepting its smaller filament, has the same dimensions as the corresponding G.L.S. lamp and can be burnt at the same angles, enables one floodlight to be used for two widely differing distributions. Tolerance in focusing may allow further variation. A change of front glass can also be used to modify the beam, a stippled glass widening the beam in all directions as compared with a clear one, while a spreader glass employing refracting prisms can be used to widen the beam in one plane while leaving it substantially unaltered in others. Other devices include spill shields for cutting off unwanted light and visors which redirect useless light in directions where it may be useful. Finally, colour screens can be mounted on the face of a flood to alter the colour of the light.

(2.2) The Floodlight Beam

In the above remarks the terms "beam" and "beam-spread" have been used. The full width of the beam of light from a floodlight is, of course, determined by the absolute cut-off, but particularly with narrow beam floodlights, the useful light is likely to be confined within a much narrower angle. For installation design purposes it has been found convenient to call this angle the "beam-spread," and it has been defined in effect as the angle subtended at the source within which the illumination on a plane normal to the axis of the beam will not have a greater diversity than

10 to 1. This is a quite arbitrary limitation of the beam, but there are sound reasons for its adoption. Firstly, it embraces all the light which can be considered as controlled by the reflector, and, secondly, practical experience has shown that variations of 10 to 1 in illumination on the kind of object which is usually the subject of floodlighting is barely perceptible to the human eye at the distance at which such objects are likely to be viewed. In practice, if an area is completely covered by the beams from a battery of floods, the inevitable overlap combined with some build-up from spill light outside the limits of the beam as defined above, will tend to make the diversity less than 10 to 1. When, as is frequently the case, the floodlight beam strikes the object at an oblique angle the diversity of illumination over the area covered by each beam may be greater than 10 to 1 owing to operation of the cosine law, and overlap must be correspondingly greater.

All the light emitted from the floodlight outside the beam is termed "spill light" and, as we shall see later, much of this can be usefully employed. "Spill light" should be distinguished from "waste light," which is that which misses the target altogether and which may, and usually will, include some of the light within the beam. The term "beam-angle" has often been used in the past with much the same meaning as "beam-spread," but has also been used with a different meaning related

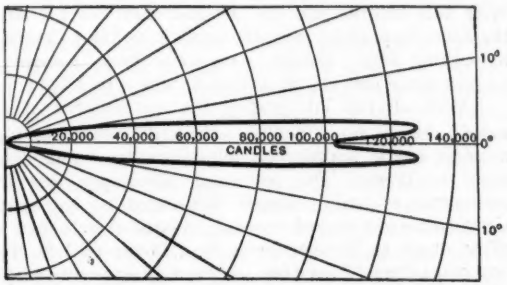

Fig. 1. Typical curve of light distribution from a narrow beam symmetric floodlight.

to the visibility of a light source from a distance, a phenomenon which is of importance in relation to beacons and such devices, but has no bearing on floodlight practice. The B.S.I. have now endorsed the term "beam-spread" for floodlighting use. The luminous flux within the "beam-spread" is called the "beam lumens," and another term, "beam factor," is sometimes used to indicate what proportion of the bare lamp lumens is emitted within the beam.

(2.) Floodlight Data

The technique of floodlighting involves building up the light over an area with a multiplicity of beams in such a manner that reasonable uniformity of illumination is obtained, and it may be well to examine the data relating to his equipment which a lighting engineer will find helpful when planning an installation. Firstly, he will obtain much help from a polar curve of light distribution. Polar curves of typical symmetric and asymmetric floodlights are given in Figs. 1 and 2. For symmetric beams a single curve gives all the information. For asymmetric beams more than one is necessary and usually two curves, one lying in the plane containing the axis of symmetry and one in a plane at right angles to it passing through the peak, are shown. Then it will be helpful for him to know the area covered by the beam at typical offsets and angles of elevation within limits appropriate to the particular design of floodlight. Examples related to the floodlights covered by Figs. 1 and 2 are shown in Tables 1 and 2. Then it will be useful to know the average illumination which will be obtained over these areas with floodlights at typical spacing—offset ratios.

Table 1.

Area covered by beam of floodlight depicted in Fig. 1.

Illuminated Area	Angle of inclination of beam	Dimensions of illuminated area in feet		
		Offset Distance in Feet		
		35	50	80
	deg.			
Width	0	20	30	50
Length	—	20	30	50
Width	30	24	32	55
Length	—	28	40	65
Width	45	28	40	65
Length	—	45	60	100

With this information the designer can use his covering power diagrams in much the same way as he uses illumination contour diagrams to build up illumination over a working area. Finally, data as to beam lumens and total light output will help to give some idea of the extent to which spill light may help in the total build-up.

With all this information the mathematics of working out an installation plan should present no difficulty. The only additional factor which has to be taken into account is the appropriate allowance for waste light, i.e., light which will entirely miss the target. The percentage allowance that should be made will vary with circumstances and is largely influenced by the shape of the object to be lighted. Very irregularly shaped or small, isolated objects such as statues, may need an allowance of as much as 33⅓ per cent., or a factor of 1.5. For regularly shaped buildings of any magnitude 15 per cent., or even 10 per cent., may be sufficient. Typical examples of the working out of the arithmetic can be found in a number of trade catalogues and handbooks.

(2.4) Equipment Design

Before considering the art of designing a floodlighting installation, a few words regarding the design of floodlights may not be out of place. Robust construction and good workmanship are essential. Floodlights have to operate out of doors in all

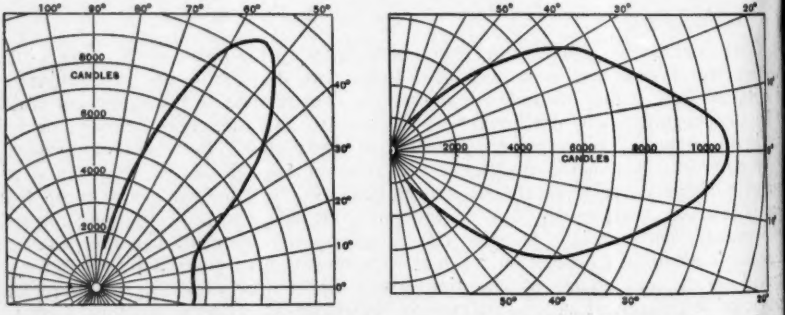

Fig. 2. Typical curves of light distribution from an asymmetrical floodlight providing a fan of light: (a) in vertical plane of symmetry. (b) in plane right angles through peak.

Table 2.

Area covered by beam of floodlight depicted in Fig. 2.

Illuminated Area	Angle of inclination of core of beam.	Dimensions of illuminated area in feet		
		Offset Distance in Feet		
		15	25	40
	deg.			
Width	45	15	25	40
Length	—	20	33	53
Width	55	15	25	40
Length	—	33	55	88
Width	65	15	25	40
Length	—	42	70	111

weathers, they usually employ high wattage lamps with their accompaniment of great heat, and they may be required to operate at a wide variety of angles of tilt; for example, the same type of unit may be required in one installation to flood downwards on to a football pitch, in another upwards to the top of a church spire. Floodlights may be ventilated or unventilated. If the former, care must be taken that water cannot enter at any normal angle of operation and it must be easy to get at the inside to clean out the dirt that will inevitably enter as the floodlight cools after use. If, on the other hand, they are unventilated, the provision for heat dissipation must be such as to ensure that reflectors and lamps are not damaged at any permissible angle of operation. Mirror glass reflectors are generally used but their silvering must be well protected to stand up to the operating conditions. Metal reflectors, such as anodised aluminium or stainless steel, are sometimes used, but though more strong mechanically and less likely to be affected by heat, they are generally less efficient and more liable to mechanical distortion. Anodised aluminium has the highest reflection factor but is liable to corrosion whenever moisture, e.g., due to condensation, is present in conjunction with corrosive agents such as are found both at the seaside and in many industrial centres. If floodlights are designed to be used only within certain specified angles of tilt, the limitations should be indicated on the floodlight.

Finally, too great attention cannot be paid to the facilities for accurate focusing and training. Floodlights must be cleaned and relamped periodically and in the process both focusing and training are likely to be disturbed. A pre-set locking device which by the release of a single piece of mechanism allows the unit to be tilted to any desired angle for cleaning and then reset with an assurance that it is trained back in the right position, is very desirable. Some floodlights are fitted with sights for training and an optical projection device for focusing so that it is possible to perform the whole process in daylight. When it is remembered that floodlights are often mounted in relatively inaccessible positions and that frequently dazzle and haze make night training very difficult, the advantages of such devices are obvious.

(3) Installation Design

So much for the more theoretical and engineering aspects of floodlighting. A knowledge of them and of normal illuminating engineering practice with regard to such matters as avoidance of glare and the provision of sufficient light, will enable

any competent lighting engineer to design a scheme of industrial floodlighting for purely utilitarian purposes, but in designing floodlighting for spectacle a number of other problems arise.

As we said earlier, floodlighting for spectacle is a form of art practised usually by engineers. It involves "painting" with artificial light objects which are normally seen in daylight. In that fact lies much of the criticism that has been directed against floodlighting. Some people suggest that if floodlighting does not reveal a building with the same shadow values and contrasts as in daylight, it must be bad. No floodlighting engineer claims to reveal a building exactly as it appears in daylight (he may claim that sometimes he makes it look much more beautiful!) but surely the criterion must be whether the object of floodlighting looks beautiful or effective and not whether it mimics daylight. On this criterion, whatever a minority may say, the vast majority will enthusiastically encourage floodlighting. We can, however, learn by studying under what daylight conditions an object looks most effective, and some of the lessons from such observation will appear as we examine the factors involved in designing a typical installation. For simplification we will discuss first the floodlighting of a building but many of the points that arise apply equally to other objects, the special features of which can be examined later.

(3.1) Direction of Main Lighting

The first thing to be decided is from what main direction the light should be projected on to the building. A number of factors influence this decision. The angle from which the building is most likely to be viewed is very important. If the main floodlighting is directed from the same angle, shadows are flattened out and the building appears relatively dead and featureless. The main floodlighting then must be at an angle to the direction of view; but if it is too oblique the shadows may be too long or too sharp for the best effect. Next, the architectural features of the building must be considered. The main direction of lighting must be such that fenestration and any projecting features are revealed by appropriate shadows. This means that lighting oblique to the building frontage will almost invariably be more effective than lighting straight on to it. Oblique lighting will also bring out the three dimensional effect of the building as a whole, the lighting on face and sides being graded naturally (Fig. 3).

(3.2) Supplementary Lighting

Lighting supplementary to the main lighting may be required for several purposes. The first of these is to soften the shadows which will be cast by the main lighting and to give shape to the building by applying a soft light to those parts of it which will be in complete shadow from the main beam. This is one of the lessons we learn from daylight (the advantage of oblique lighting mentioned above was another). However sharp the shadows cast by direct sunlight, there is always in daylight a compensating soft light from the whole arc of the sky. In floodlighting this softening effect may sometimes be sufficiently produced by spill light from the main floodlight batteries but almost always some additional cross light coming from an opposing angle will enhance the effect.

The second function of supplementary lighting is to provide highlights, usually by emphasising the perspective of major architectural features such as colonnades, balconies or major set-backs in the building whether horizontal, such as parapets, or vertical, such as the space between deep buttresses. The lighting of such features usually necessitates mounting floodlights very close to the building so that high brightness is very easily obtainable; the temptation to go to excess must be curbed. The lighting needs to be applied discreetly so that the features are not too bright in contrast with the main lighting (Fig. 4).

Finally, supplementary lighting may be desirable to reveal parts of a building

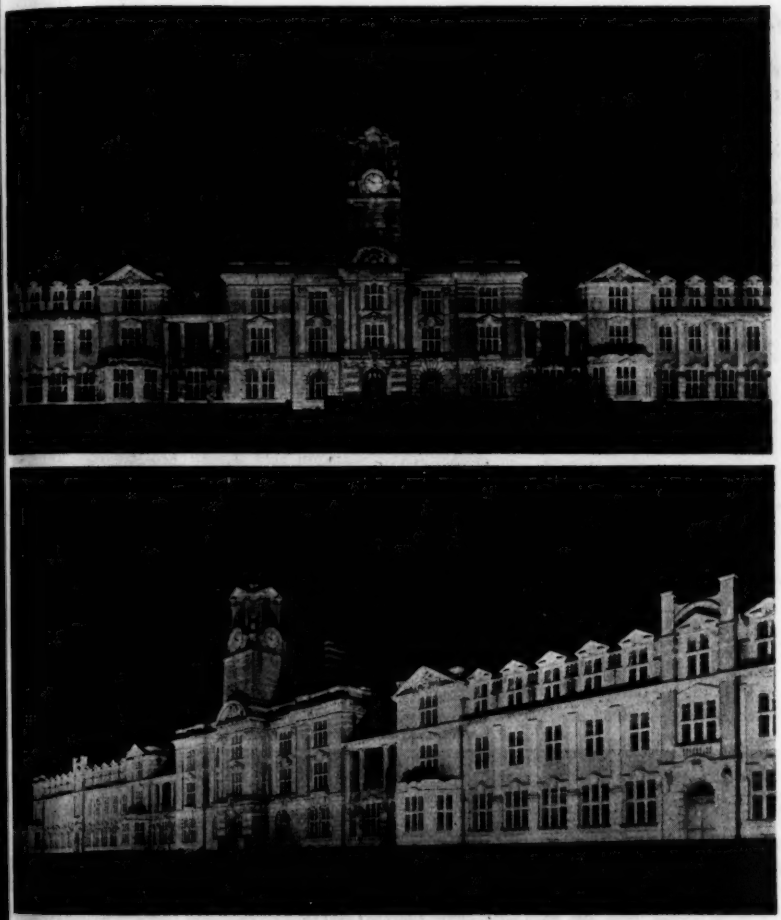

Fig. 3. A building lit from the flank and viewed from the front (*above*) reveals appropriate shadows, but when viewed from the direction of the floodlights (*below*) shadows almost disappear and much of the three dimensional effect is lost.

hich the main floodlights cannot easily light, for example, parts of the roof or of the ace which are shadowed by projecting building at lower level. A fine building should lways be shown as a whole so far as its overall outline is concerned. Far too often he proportions are spoilt by apparent decapitation (Fig. 5).

The extent to which supplementary floodlighting should be used to bring out small etail, depends to some degree upon the distance from which the object is to be viewed. mall detail can only be seen from relatively short distances and it is waste of light nd ingenuity to give too much attention to it if the installation can only be observed rom a distance. Thus it would be foolish to try to bring out detail of the stonework n the north rampart of Edinburgh Castle which can only be viewed effectively from rinces Street some hundreds of yards away.

(3.3) Concealment

While so far we have considered the desirable positions for placing floodlights provided there are no limitations on our choice, there is one further factor which in practice very often has a decisive influence, namely the problem of finding suitable

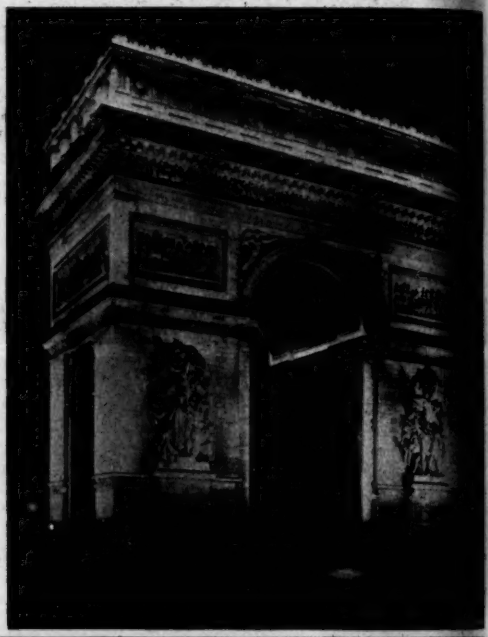

Fig. 4. Examples of supplementary lighting on the cornice (*right*) and between the buttresses (*below*) to introduce highlights, and emphasise perspective.

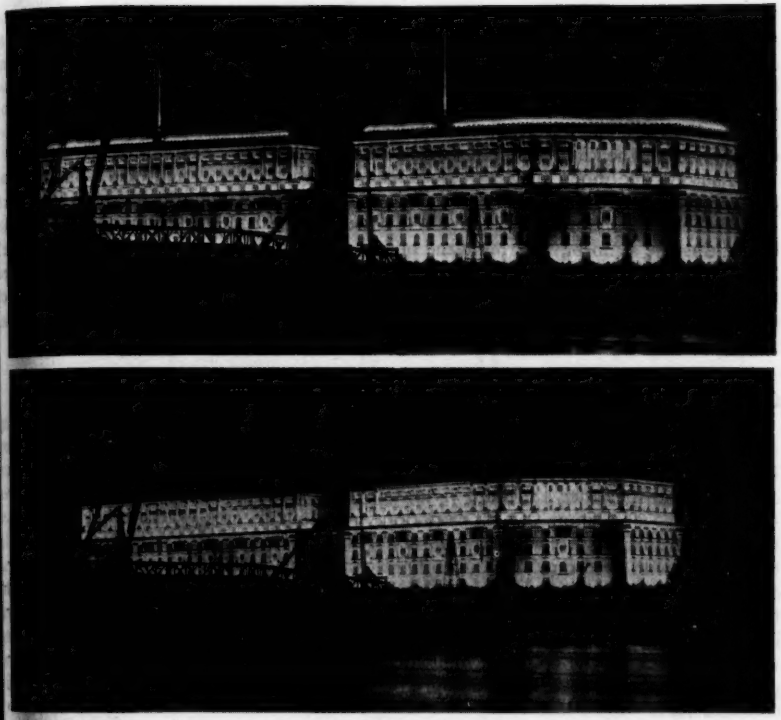

Fig. 5. Note how the proportions of the building alter as the roof appears or disappears.

places to fix the floodlights. It is no good deciding that "X" on plan marks the ideal spot for mounting your main battery of floods, if "X" is in the middle of a public highway or on inaccessible premises. All the previous desiderata therefore may have to be sacrificed to a less or greater extent to meet the limitations imposed by the circumstances. Floodlights are unsightly objects and the direct light from them is very glaring. Consequently it is desirable to make sure that no part of the lamp or the flashed area of the reflector is visible to the onlooker and to keep the fittings as well hidden or camouflaged as possible. Frequently they can be hidden amongst shrubs or behind banks, and failing that, artificial concealment may be contrived for fittings in the open, while for feature floodlights on the building, pillars, balconies and parapets may provide sufficient cover. Other devices that have been used include ornamental post top lantern housings which look like ordinary decorative lanterns when seen from every side except that on which the floodlight beam emerges, or decorative brackets projecting from the building face, sometimes also combined with lantern units. Effective concealment of equipment undoubtedly enhances an installation very greatly and architects designing buildings which are likely to be floodlighted should make provision for the necessary facilities.

(3-0) Selecting the Right Floodlight

The principal other problems involved in selecting positions for placing floods are bound up with the selection of the most appropriate type of floodlight for the

job. For obvious reasons of economy "waste light" must be kept to a minimum and sometimes a slight change in the position of the floodlights may make it easier to direct the maximum amount of light on to the building without materially affecting aesthetic considerations. The selection of the most appropriate floodlight for use on any building and at any given offset from it, is a straightforward illuminating engineering problem which any competent lighting engineer should be able to solve with the aid of the kind of technical data described earlier.

There is one other problem associated with waste light which may arise, and that is the problem of preventing it going into places where it may do harm. Light which passes above a building into the night sky is usually harmless, although on hazy nights by lighting the atmosphere around the building it may destroy the sharpness of outlines. But light which goes on to a neighbouring building which is not intended to be lighted may seriously affect contrasts, and light that goes past a building into the eyes of passers-by will cause unpleasant glare. Where there is danger of such effects as these the undesirable waste light must be intercepted by louvres or spill shields.

(3.5) Use of Colour

Colour in floodlighting can be provided either by interposing suitable screening material in the path of light from incandescent lamps or by employing self coloured light sources, such as neon, sodium or mercury lamps. In general, the colour effects obtained with the latter are more vivid, but the sources do not always lend themselves to long-range projection. Slight variations in colour to create additional contrasts or to bring out the perspective of special features can often be used effectively, but should be applied with restraint. Coloured light can also be well used to bring out natural colours in the object. For example, red brick glows very effectively under the light from neon floods and cotswold stone responds to sodium. Where, however, the building is comprised of a mixture of coloured and neutral material, e.g. a red brick building with stone facings, the coloured light must be mixed with white, otherwise the neutral portions will also be revealed in colour and the contrast between them and the natural coloured parts will be lost.

(3.6) Illumination Values

High intensities of illumination are by no means a criterion of good floodlighting. The correct illumination is determined by many factors, of which the three most important are the function of the building, its reflection factor, and the brightness of the surroundings. Reflection factors vary tremendously not only with the nature of the material, of which the building is constructed, but also with its state of cleanliness. Ritchie (1) gives some figures taken from London buildings which show reflection factors of under 10 per cent. for uncleaned red brick and Portland stone, rising to nearly 40 per cent. and over 60 per cent. respectively when the same buildings were cleaned. There is one point here which helps the floodlighting engineer, namely that buildings tend to get much dirtier towards the bottom than they do on the upper stories. In so far as the floodlights can usually be more easily placed on the level of the lower stories with a consequently much longer throw to the upper parts of the building, the engineer can compensate for the lower reflection factor with a higher intensity of light, a compensation which would be far more difficult to achieve if the dirtier parts had been at the top. The next factor affecting illumination requirements is the brightness of surroundings. An effectively floodlighted building must stand out from its neighbours. Consequently, appreciably higher illumination is needed for a building in a brightly lit street than for a similar building isolated from all neighbours in an unlighted countryside. The E.L.M.A. Lighting Service Bureau publish a table of recommended values (2) which is reproduced in Table 3. One qualification must be

Table 3.

Recommended illumination values for floodlighting.

Nature of Surface	Condition of Surface	Reflection Factor	Lumens/sq. ft. Recommended		
			District Brightness Low	District Brightness Medium	District Brightness High
		per cent.			
White Glazed Brick	Clean	85	1.5	2.5	4.0
	Fairly Clean	60	2.0	3.5	6.0
	Fairly Dirty	30	4.5	7.5	12.0
Portland Stone	Clean	60	2.0	3.5	6.0
	Fairly Clean	40	3.5	5.5	9.0
	Fairly Dirty	20	6.5	11.0	18.0
Concrete	Clean	45	3.0	5.0	8.0
	Fairly Clean	30	4.5	7.5	12.0
	Fairly Dirty	15	9.0	15.0	24.0
Middle Stone	Clean	40	3.5	5.5	9.0
	Fairly Clean	26	5.5	9.0	14.5
	Fairly Dirty	13	10.5	17.5	28.0
Dark Stone	Clean	30	4.5	7.5	12.0
	Fairly Clean	20	6.5	11.0	18.0
	Fairly Dirty	10	13.0	22.5	36.0
Yellow Brick	Clean	35	4.0	6.5	10.5
	Fairly Clean	24	5.5	9.0	14.5
	Fairly Dirty	12	10.5	17.5	28.5
Red Brick	Clean	25	5.5	9.9	14.5
	Fairly Clean	16	8.5	14.0	22.5
	Fairly Dirty	8	17.0	28.0	45.0

General Recommendations

	Lm/sq.ft.		Lm/sq.ft.
Bathing Pools	0.5–2.0	Gardens	0.5–3
Building Construction ...	4 –	Loading Docks	2 –4
Building Excavation ...	1 –2	Quarries	2 –4
Car Parks	0.5–1	Railway Yards	0.5–2

made, however, to accepting these recommendations at their face value, namely that the function of a building also has a bearing on what illumination is desirable. Every good lighting installation must create the right atmosphere. The blaze of light that may be appropriate for a new town hall or a modern commercial building may be

quite out of place if applied to an ancient monument or a church. Very often an air of mystery is more appealing than the revelation of every detail.

We have mentioned earlier the question of diversity. In general, a diversity of 10 to 1 is little apparent to an observer at a reasonable distance, and selective weathering of building faces will usually conceal far greater diversities than this. The important thing is not to get stray bright patches and particularly to avoid striations. On the other hand, grading of illumination may be deliberately contrived to help produce an effect of perspective.

(3.7) Focusing and Training

Before examining a typical installation as an example there is one final point that cannot be over-stressed, and that is the importance of correct focusing and training of the floodlights. The effect usually depends upon build-up from a number of units, and if one is incorrectly trained it can easily spoil the whole picture. When floodlights are first switched on to a building, the effect can be so startling that one temporarily loses one's critical faculty, but a little fiddling here and adjustment there will usually make an amazing difference to the homogeneity of the picture. In this connection it must be remembered that the viewpoint of the public will not be the same as that of the man adjusting the floodlights, and that the powers of appraisal of the result will also be affected for him by the glare of the floods in his immediate proximity.

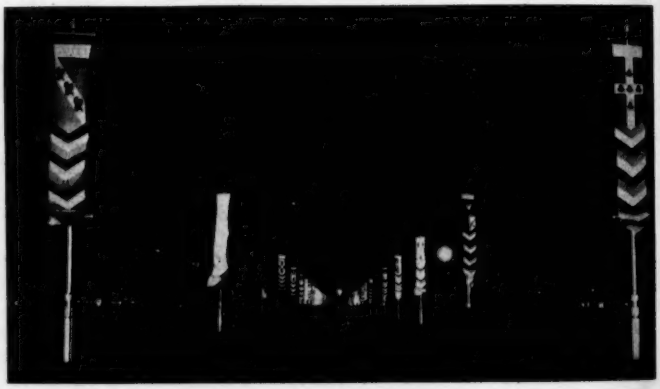

Fig. 6. Only one floodlight is used to illuminate this scene.

Consequently, this task of adjustment should always be carried out by at least two people, one of whom should be in the position from which the public will see the installation from which position he can direct the adjustment.

So far in this country little use has been made of very high powered lamps for floodlighting, except in the field of aviation lighting, and in general 1,500-watt tungsten lamps are the most powerful that have been used. Even with this size many lamps are necessary to light a building of any magnitude. The introduction of very high-powered lamps, such as the compact source mercury lamps and the high wattage incandescent lamps used in studio work, may make it practicable to carry out effective floodlighting installations with fewer units and from greater offsets. The advantage of greater offsets is to make shadows more nearly of the same relative depth than is possible when floodlighting from close-up, and to this extent to simulate sunlight more nearly; but if unduly harsh shadows are to be avoided some supplementary lighting will always be necessary to make the contribution which in daylight is made by the whole arc

of the sky. Whether the desired effect can be obtained by two such super floods mounted at appropriate opposing angles is yet to be discovered. The technique is receiving considerable attention on the Continent (Fig. 6).

(3.8) Analysis of a Typical Installation

Before considering some of the other fields of floodlighting, it may be profitable to examine a typical building floodlighting installation in the light of what has been said. Not much complete data on floodlighting installations is available, but the original installation at Buckingham Palace was very fully analysed by Ritchie, and its design illustrates a number of features mentioned above.

It was considered that the natural main viewpoint was from the front of the building by the Victoria Memorial and along the Mall, so it was decided to direct the main beams from the left front. Fig. 7 shows the layout plan of the floodlights. The choice of floods, long range narrow beam, was dictated by the fact that the forecourt had to be kept clear for traffic so that the floods could only be put on the outer perimeter. Very little concealment was possible, but some advantage was taken of the low wall at the foot of the railings and a line of small shrubs in tubs between the floodlights and the wall gave some concealment. All the floodlights to the left were trained at the same angle so as to get the major shadows across the front of the building to the same depth. The spill light from the battery just left of the central

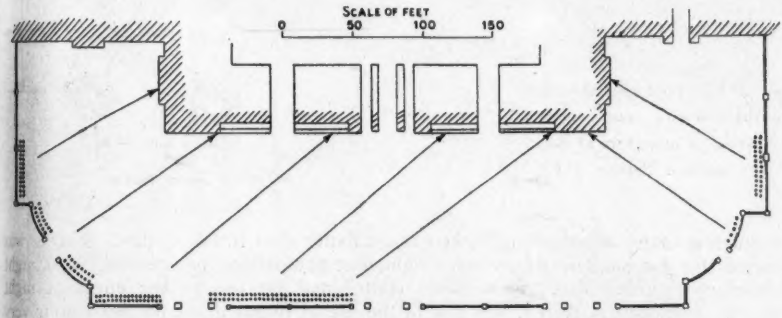

Fig. 7. Plan of courtyard of Buckingham Palace showing arrangements of floodlights.

gate gave all the softening effect necessary for the left half of the building, but, as one travelled farther to the right, the effect of this light diminished, and the small battery of floods at the right hand end was provided to supply the necessary compensation. These floodlights were fitted with stippled diffusing front glasses so that they would merely provide a softening light and not cast perceptible counter shadows to those from the main batteries. The extreme right-hand battery took care of the end wall which received no light from the main batteries. To control the diversity on the face it was necessary to train the floods in pairs, one at a slightly higher elevation than the other (Fig. 8).

On the first occasion that Buckingham Palace was floodlighted permission could not be obtained to place supplementary floodlights on the three balconies, but on subsequent occasions this has been done, thereby amplifying the three-dimensional effect of these features and introducing high lights. Additional floodlights mounted behind the parapet on the roof have also been provided to light the Royal Standard.

One other interesting point was brought out by Ritchie, namely, that as with other types of lighting installation, the client can sometimes do something to make the result more effective. Criticism was directed against the installation on the ground that

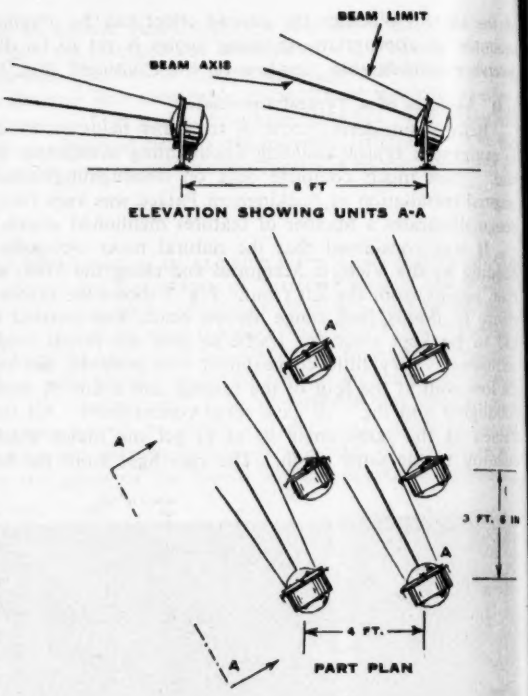

Fig. 8. Part plan and elevation showing forward and upward inclination of projectors at Buckingham Palace.

the building under floodlighting looked much flatter than it did by day. Ritchie was satisfied that his shadow values were right, but comparison between day and night photographs showed that the windows contributed far less to the effect at night (Fig. 9). This, he discovered, was due to the use of blinds of an outside colour very similar to that of the stone with which the building is faced. Fig. 10 shows the effect that would have been obtained if the blinds had been dark in colour.

A very careful photometric survey was made to determine the illumination values. They varied from a maximum of 45 lm./sq. ft. to a minimum of 5 lm./sq. ft., with an average of 15 lm./sq. ft. Comparison with Table 3 will show that these were on the high side for a fairly clean building in Portland stone, even though the surroundings are brightly lit, but the fact that it was, so to speak, a centre-piece of the celebrations and that it was intended to be seen the full length of the Mall from Admiralty Arch, justified some lavishness.

(4) Some Floodlighting Applications

(4.1) Floodlighting for Advertisement

The foregoing pages have examined in some detail the problems that arise in floodlighting buildings, and many of the points brought out are applicable in other fields. There is, however, one type of building floodlighting where some of the precautions may be relaxed, namely in floodlighting for advertisement. The object of such floodlighting is to catch the public's attention either to make them identify a certain building or to make them talk about a certain firm or product. In such

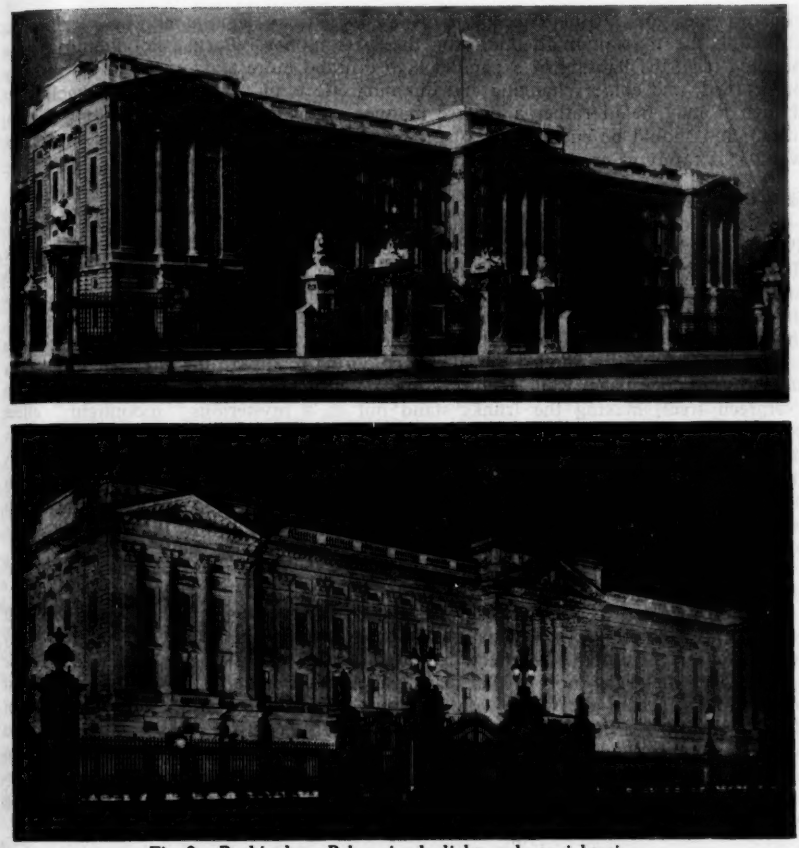

Fig. 9. Buckingham Palace in daylight and at night time.

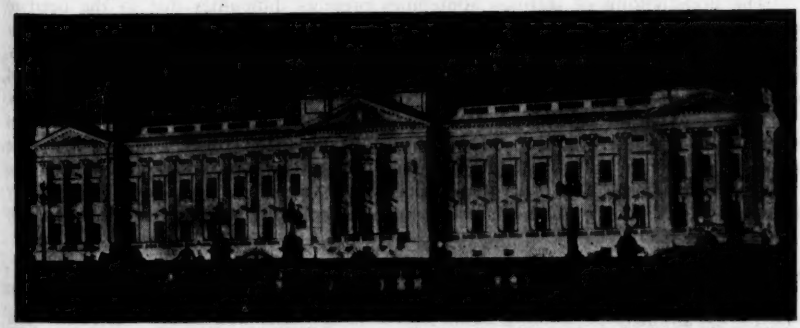

Fig. 10. Showing the effect of floodlighting at Buckingham Palace had the blinds been dark in colour.

circumstances the artistic conception as a whole may legitimately be sacrified to attracting the maximum attention for the least money. Partial floodlighting of a building (e.g., the lighting of a parapet high up) and more blatant use of colour may be justified; and colour changing and dimming effects may add to the spectacle even though it may be in rather a bizarre manner. This does not mean that unsightly installation should be encouraged, but it is a saving grace of floodlighting that at its worst it is rarely as crude as other forms of luminous advertising.

(4.2) Gardens

Let us consider now some other fields where floodlighting can be effectively applied. Parks and gardens are worthy subjects. Here much of the art lies in so placing the floodlights that they are concealed from the public at normal directions of approach and in so covering the area with softly diffused light that the inevitable high spots do not make the whole picture appear patchy. Colour can be used to advantage, in fact incandescent lighting is often rather ineffective on foliage. Warm colours can be very effectively applied to autumn colouring (compare the effect of the setting sun on autumn foliage) while high-pressure mercury lighting can be very effective on evergreen trees, making the trunks stand out in a mysterious "moonlight" effect contrasted with the vivid green of the foliage. Some distortion of flower colours may be justified if the effect, though untrue, is still beautiful. For example, one very rarely sees that lovely flower bougainvillea in this country, but a rose pergola under high-pressure mercury light will have an appearance very like it. When water is present striking effects may be obtained by arranging the lighting to take full advantage of reflections.

(4.3) Fountains

Fountains present another worthy subject for floodlighting. To get the best effect, control of the jet form is as important as control of the lighting. A fine spray will allow misty, rainbowlike effects to be produced, while larger drops will increase sparkle. To make the most of this sparkle effect the floodlights should be placed just below the surface of the water with the front glasses just awash. The bouncing of the falling drops on the surface will then make a very beautiful effect. A combination of automatic jet change and three-colour dimmer-control of the floodlights, the two mechanisms being slightly out of synchronism, make it possible to have an ever-changing kaleidoscopic effect without repeating any particular combination for long periods.

(4.4) Statuary and Flags

The floodlighting of statuary sometimes presents difficulties due to the need to get a three-dimensional effect when the object is viewed from any direction. Under these conditions the shadow effects may sometimes best be obtained by artificial means, i.e., by deliberately reducing the amount of light that falls on what should be shadowed portions, even though such portions are receiving light direct from some of the floodlights.

Flags provide an attractive subject for floodlighting, but much light is needed to make them show up brightly. Floodlights must be spaced over a sufficiently wide arc to ensure plenty of light striking the face of the flag at whatever angle it may be blowing in the wind. Too often floodlights trained to make a flag show up brilliantly on one night will prove quite ineffective on another when the wind is blowing from a different quarter.

(4.5) Utilitarian Floodlighting

Floodlighting has many utilitarian, as distinct from spectacular, uses. Underwater floodlighting of swimming baths combines spectacle and utility. It contributes to safety by making visible any bather who may go under water and not come up again, and enables the detailed movements of expert swimmers and divers to be watched

to the delight and instruction of others. In floodlighting underwater it must be remembered that the water acts as a diffuser so that a very powerful punch of light is needed to carry the lighting right to the centre of a wide bath. A flat, fanlike light distribution just under the water surface is best, as the top surface of the water acts as a reflector and stops the beams of light from glaring in the eyes of spectators. A line filament lamp in a horizontal, parabolic trough provides a very satisfactory spread of light.

Floodlighting for sports such as football is another utilitarian application where the problems are mainly those which the lighting engineer meets in his other activities. The greatest difficulty is to prevent glare in the eyes of spectators or players. To this end floodlights must be mounted very high (some football grounds in America have floodlights mounted on platforms 150 feet up), and each unit must be carefully focused and trained to look after its own patch of the field without causing glare to other parts. Louvres or spill shields are invariably required, and accurate pre-set devices are essential if the installation is to be satisfactorily maintained.

In the field of purely industrial floodlighting there are many applications, of which railway yards, quarries and colliery pit heads are typical examples. Many of the remarks concerning sports floodlighting apply equally to these applications, but the problems are essentially in the realm of straight-forward illuminating engineering. The floodlighting of airfields is now generally superseded by other visual aids to night-flying, but floodlighting is still sometimes used on sea-dromes, although the problems here are complicated and far from straightforward illuminating engineering. Very accurate control of the beam is essential to ensure that light cannot dazzle the pilot, and here again a flat fan of light of high magnification and wide-spread in the horizontal plane, but with a narrow beam and very sharp cutoff in the vertical plane, is needed. One other application in which floodlights of similar, if not so accurate, distribution are needed is worthy of mention, namely floodlighting for protective purposes around such places as oil depots in the desert, prison camps and similar isolated places.

(5) Conclusion

In conclusion one might sum up the main essentials for a good floodlighting installation as:—

(1) Selection of the right position from which to direct the main component of light, having regard to the position from which its target will mostly be seen, and the possible sites available.
(2) Selection of floodlights with the best light distribution for use in these positions.
(3) Determination of the amount of supplementary lighting that may be necessary, whether to fill in gaps in the main coverage or to introduce high lights and improve perspective.
(4) Good concealment or camouflage of the floodlights.
(5) Very careful focusing and training of each and every floodlight.

References

(1) T. E. Ritchie, G.E.C. Journal, Vol. IV, No. 4, Nov., 1933.
(2) Electric Illumination Handbook, No. 6 (Floodlighting) (Lighting Service Bureau).

Acknowledgements

The author wishes to acknowledge with thanks the assistance received from the General Electric Co., Ltd., in connection with the provision and operation of the model with which the paper as presented was illustrated; also the same company and the Cie. des Lampes, of Paris; Messrs. Perrot, Duval and Co., of Geneva; the B.T.H. Co., Ltd.; Holophane, Ltd.; Siemens Electric Lamps and Supplies, Ltd.; and the E.L.M.A. Lighting Service Bureau for the loan of lantern slides and illustrations.

Discussion

M. JEAN J. CHAPPAT (France) said the paper would serve as a refresher to all engineers and architects engaged in the design of floodlighting installations. The paper was very timely and in addition to its usefulness in providing a new generation of lighting engineers with a work of reference, it was certainly a stimulant to the old brigade of enthusiasts who carried out such fine floodlighting installations in Europe between the two world wars.

At one time or another before the catastrophe of 1939, every monument of note in Europe was floodlighted either permanently or on special occasions, and the public became "floodlight conscious." After five years of darkness and depression, the first floodlighting of the monuments of Paris caused an outburst of public enthusiasm that Frenchmen would never forget. Unfortunately, due to power shortage it was only possible, at the moment, to enjoy this thrill on rare and special occasions, but the situation was improving and French engineers were making their plans for a floodlighting revival. This paper was evidence that the same thing was happening in Great Britain.

Technically, the problems in France did not differ greatly from those in Great Britain except that the architecture had a different character.

It was wisely stated in the paper that floodlighting had many applications in addition to the illumination of artistic monuments and buildings. There was a vast amount to be done in the utilitarian and industrial fields. He had been particularly touched by the reference to protective lighting for prison camps and similar isolated places. Well did he know from personal experience the effectiveness of floodlighting on a roll call at midnight in a concentration camp. That was one field of application that he, for one, wished had never been thought of.

Everybody would agree with the statement in the paper that "The key to the floodlight distribution is the reflector," and he wondered why more use had not been made of reflectors which provided an asymmetric distribution with a sharp cutoff, instead of symmetric reflectors and glass lenses to change the beam pattern.

Recently in France they had had considerable success with projectors of Swiss design in which multiple section reflectors were incorporated and which could be made elliptical or parabolic according to the beam pattern required. The lamp was half silvered and the reflected light from it was controlled by the mirrors of the projector and directed on to the area to be floodlighted. A variety of beam patterns could be produced by adjusting the reflectors, and it had been found that rectangular or square beams with a sharp cutoff were particularly suitable for the illumination of buildings where a precise outline without "spill light" and a minimum of "waste light" was desired. The projectors could be equipped with either 2,000- or 3,000-watt lamps, and the beam spreads available were as follows:

Parabolic	*Elliptical*
60 deg. × 5 deg.	60 deg. × 20 deg.
40 deg. × 5 deg.	40 deg. × 20 deg.
25 deg. × 5 deg.	25 deg. × 20 deg.

The reflectors were made of pure aluminium polished and treated by the "Alzac" process, which resisted corrosion even in the sea air.

With projectors of this type, the units were normally installed a distance of 200 to 250 ft. from the target, but in some cases, by the use of special reflectors, excellent results had been obtained with the units placed at a distance of from 900 to 1,200 ft. from the surface to be illuminated. With this system, a smaller number of projectors was required than with conventional types and satisfactory results could be obtained with considerably less power consumption. For example, to

illuminate Notre Dame Cathedral on the façade facing the River Seine, only eight 3,000-watt special projectors were required instead of 80 1,000-watt conventional projectors formerly employed; and the lighting result was better.

Another interesting example was the façade of the Chateau de Versailles where 10 3,000-watt special projectors did a better job than the 90 1,000-watt conventional units which were installed previously.

(Lantern slides were shown illustrating the results obtained with the new system.)

Many other projects were under study and in course of erection. The power supply was getting better and very soon it would be possible justly to describe beautiful Paris as "La ville lumiere." He invited the members of the Society to go over to France to inspect this work.

MR. J. G. HOLMES said that the author's presentation had made the subject seem simple and straightforward, but a careful reading of the paper showed that the practical details often involved many complex problems. As Dr. Sayce had emphasised in his lecture on "Visual Deception," much of our impression of our surroundings and much of our appreciation of particular objects came from the sense of "texture"—the relative light and shade of large areas and the local contrast of details—and the task of displaying the texture of a building was not easy. (Lantern slides were shown to illustrate this point.)

The principal factor in designing a floodlighting installation was the location of the fittings, which largely determined the shadow values. The other variables, such as the type of lantern, the kind of lamp, the intensity, the angular spread and the distribution of the light, were under the control of the designer and were almost entirely settled as a consequence of his choice of sites for the fittings. The greatest value in the designer's skill and experience lay in his ability to reconcile the conflicting requirements of accessibility and concealment whilst maintaining the proper placing of the light sources. The author had emphasised this point in presenting the paper, although it was not made as clear as it might have been in the printed paper. Incidentally, he asked the author what was the precise meaning of "offset distance"?—Reference was made to the spacing/offset ratio in section 2.3 and also in a current draft B.S.I. specification but it had nowhere been clearly defined.

Another point which called for consideration was the avoidance of a luminous atmosphere around the floodlit building. As an example, Edinburgh Castle lost much of the illusion of a fairy palace on a misty night and unfortunately the British atmosphere was often very misty. It seemed that part of the peculiar delight of floodlighting was lost if one became conscious of the beams of light, even more so than of the fittings. For the same reason, he was rather doubtful of the results which could be given by very long throws up to 300 yards as mentioned by M. Chappat.

In reading the paper, Mr. Holmes had been impressed by the disproportionate relationship between the brightness values for spectacular floodlighting and those suggested for areas where work had to be done. The figures in Table 3 corresponded to a luminance (or photometric brightness) of 1.3 foot-lamberts to 3.6 foot-lamberts for floodlighting, but the figures for railway yards and docks corresponded to a luminance of only about 0.025 to 0.5 ft.-l. It seemed wrong that the field of view in a working area, where the tasks might involve movement or fine detail, should be given brightness values of perhaps less than one tenth of those thought necessary for looking at the features of an unmoving building, however decorative it might be. This inconsistency was doubtless bound up with the economics of the different applications because the values which might be deduced from the charts in the I.E.S. Code were much less divergent.

Finally, he said that whilst during the war there had been very little development in floodlighting, there had been considerable development in the design and construction

of projectors for high intensity and high efficiency. It was his hope that in the immediate future it would be possible to apply the knowledge which had been accumulated both in the design of fittings and, in some measure, in the design of installations and to use this knowledge with discrimination so as to add selectively to the interest of the visual scene without going to the extreme of drowning our buildings with too much floodlight.

Written contribution by Mr. G. GRENFELL BAINES, read in his absence by the President: I am pleased Mr. Ackerley established early in his paper that floodlighting is essentially the practice of an art. As an architect interested in the practice of an art I would say that if ever there was a field in which co-operation between engineer and architect was required it is here. However, Mr. Ackerley appears to accept the situation that this particular art should continue to be practised mainly by the engineers because he says a successful accomplishment depends on a proper understanding of artificial light; indeed, from saying that it is essentially the practice of an art as much as a science, he blandly concludes that the effect depends " in other words on the science of lighting."

I wonder how long it will be before architects bestir themselves to acquire a proper understanding of artificial lighting helped possibly by some reasonable and simple explanation of the fundamentals given by engineers who are not entirely absorbed by the intricacies of their technique; I wonder also how long it will be before engineers realise that an effect of architecture depends just as much on shadow as lighting?

Perhaps I am being unfair—they do realise it, but, alas, there is as yet little evidence to show that once they embark upon a technical escapade they feel able to pay any more than the scantiest respect to this knowledge. Otherwise why do they so readily accept the situation of lighting buildings from below, thus turning up their eyebrows and giving them a shocked look as though they were surprised, to say the least, at being discovered in the night when by all normal standards of behaviour they should be left in peace?

I would accept immediately that floodlighting by artificial means at night is a medium and a situation which does not call for imitating daylight conditions and am very pleased Mr. Ackerley should realise this for, on the whole, it is characteristic of engineers who wander into the field of aesthetics to seek for surface imitations rather than fundamental principles. However, this is not surprising; architects have been fumbling about for the fundamental principles of aesthetics for a long time and I think it is a dispensation of Providence that they will have to continue to do so.

While agreeing, therefore, that one should not mimic daylight one should realise that the directional and diffusing characteristics of daylight are fundamental factors which can inspire the expression of the artificial lighting scheme without the scheme having slavishly to imitate them.

It needs an engineer like Mr. Ackerley to realise there should be a directional bias in floodlighting, but how many Mr. Ackerleys have we?—from what I can see of most local floodlighting schemes, very few.

I hardly need to emphasise the way in which the local engineers distribute with mathematical precision their little glow lamps in front of the building victim, flooding it with light in all directions and producing a featureless façade possessing distinction only by reason of the fact it appears somewhat surprisingly out of a dark and generally more acceptable background. I say I need hardly emphasise this because lighting engineers all over the country are doing it for me in sodium, mercury and tungsten, and so on.

Even Mr. Ackerley in his scheme for Buckingham Palace fails to produce the shadow emphasis which is so necessary over an opening, with the result that the palace

balcony has a surprised look, almost as if it were saying, "I say! here's the King." Maybe this is all right and quite certainly it would be difficult for an engineer to mount floodlights above the opening so as to throw a downward shadow and restore it to its most effective appearance; not merely normal but most effective, for openings are more effective when they have a shadow over them.

All of which brings me to my main point—namely, that now we can produce powerful lights from single sources it is a good time for engineers, architects, and, I would suggest, film lighting technicians to be called together in a floodlighting team for any worth-while scheme. I must say I have learned quite an amount from my brief discussions with the people in the film world.

I am sure this paper marks the beginning of a new era of co-operation between those who are seeking to reveal form at night in its most interesting and effective way. I agree with all Mr. Ackerley's conclusions except I would follow on from No. 5 which calls for very careful focusing and training of the floodlights, by suggesting that the attention of architects and engineers should be very carefully focused on the subject and that they should join together in training; the one in appreciation of how form may best be revealed, and the other in devotion to the basic principle of artificial lighting in order that together we may produce the best effects.

MR. N. BOYDELL expressed the hope that it would be possible to get away from the "battleship" design of floodlights. Something much lighter was required and possibly plastics could be made use of to this end.

He felt that the author, following present thought, had only been concerned with the "grand" effect, i.e., the floodlighting of large buildings. Floodlighting could also be used with effect on small buildings. On the commercial side he advocated much more extensive use of floodlighting especially in seaside resorts, e.g., hotels and even boarding houses. Perhaps with an altered and cheaper design of floodlight, and bearing in mind the fact that the electricity supply authority would be interested in summer floodlighting as an off-peak load, floodlighting of façades might some day be the rule rather than the exception.

Mr. Boydell said he would like to have heard more about colour floodlighting, especially the application, where practicable, of coloured fluorescent lamps. He asked if the author had had any experience of floodlighting the sea. In the South-East they had been making experiments but with rather disappointing results, as the spectacular effects expected, when looking from behind the light towards the incoming waves, had not been obtained.

Some work had been done with coloured-light sources at the end of a pier, and he suggested that the beautiful reflection effect viewed from the shore of the moon shining on the sea on a calm September evening could be obtained in this way, the reflected beams being coloured according to the light source and even perhaps changing colour in sequence.

Referring to the utilitarian aspect, he suggested the more general use of floodlighting of children's school playgrounds in the evenings. Some lighting authorities had done a certain amount in this connection in congested areas and he felt that it was something which should be developed further.

He asked for some technical information with regard to the large-powered light sources which the author had referred to as being in use on the Continent, a few of which would do away with the ugly banks of lamps now used for floodlighting buildings.

Finally, Mr. Boydell expressed the hope that in connection with the Festival of Britain adequate general use would be made of floodlighting and that "the ship would

not be spoiled for a ha'porth of tar," an expression which was not so inappropriate if one remembered Mr. Ackerley's reference to floodlighting "painting" the subject.

MR. J. S. MCCULLOCH criticised the paper because it laid such stress on the decorative and spectacular side of floodlighting and said so little about the utilitarian aspect. Coming from Tyneside, he was interested in the application of floodlighting to shipyards. In this application of floodlighting it was felt that increased production could be obtained and the floodlighting would have to be done from above instead of from below. At the present time they were mounting batteries of five, seven, nine and ten 400-watt mercury vapour lamps on platforms 70 to 80 ft. high and aimed at giving the whole of the yard area an illumination of $\frac{1}{4}$ to $\frac{1}{2}$ lm./ft.^{2}. It was expected by the management that this would increase output and save a great deal of time at present wasted. Therefore, he hoped the author would use his great prestige and name in pushing the use of floodlighting for this kind of purpose.

DR. J. W. T. WALSH mentioned the lighting of gardens and spoke of the very effective lighting of the garden of the late Sir Clifford Paterson by tungsten lamps. He expressed the hope that the author would try out some experiments on his own garden and that in the near future the Society would have a paper on floodlighting gardens similar to the one that had just been presented. The literature on floodlighting generally was very sparse and on the floodlighting of gardens it was almost non-existent except possibly for one paper from the United States. If Mr. Ackerley would carry out some experiments on his own gardens, he believed it would revise his remarks about the use of colour in gardens.

MR. C. C. SMITH (Liverpool) commenting on the suggestion in the paper that the illumination of surfaces should be uniform, said he thought this could be overdone. A uniformly illuminated surface lacked excitement and life.

He asked for the author's experience of unventilated fittings, his own being that they tended to get very dirty inside: and, in reply to the suggestion that children's playgrounds should be floodlit, thought the children ought to be in bed at floodlighting time.

MR. J. A. WHITTAKER hoped the conference would not go away with the impression that a large number of installations could be dealt with by one or a few large light sources at a great distance. Often there would be limitations of space and offset distance making it difficult to secure positions for mounting a sufficient number of floodlights. Therefore, it would be a pity if the single unit idea was over-emphasised.

He asked the author to confirm that the Buckingham Palace floodlighting was used only when the forecourt or the main area of the forecourt was kept clear.

MR. J. M. WALDRAM asked whether the author would recommend the floodlighting of water and fountains by coloured light. It was, perhaps, a matter of preference, but in fountains it seemed to him that white light was best, for coloured light would turn something which was beautiful into something that was merely pretty. Niagara Falls under white light was very beautiful; but under coloured light it became, in his opinion, tawdry. He felt there was a little too much "lily painting" in many installations and that it may often be best to use white light and allow the object to appear in its own beauty.

One point which came out strongly from the paper—and it should be continuously borne in mind—was the importance of coherence in the direction of the light. That had been emphasised in the slides, shown by M. Chappat, of beautiful floodlighting

by a small number of sources. In these instances it seemed to him that beauty resided in the strict coherence of the directional effect.

It had been suggested in the discussion that there should be much more floodlighting; but personally he hoped that discretion would be used. Before a building merited floodlighting it ought to have some aesthetic merit; and there were only a limited number of buildings which could qualify. Moreover, successful floodlighting called for darkness as well as light; and if buildings were floodlighted indiscriminately, there would result a competition of clamant mediocrity in which the point would be lost.

When floodlighting areas in which people worked, the reactions of these people to glare had to be considered, a condition which did not apply in installations where one was only concerned with the beauty of the floodlit object.

MR. H. E. BELLCHAMBERS, referring to supplementary lighting, said he had some experience recently of a small experiment using 5 ft. 80-watt coloured fluorescent lamps. The areas lighted were about 9 ft. square, and the surface of middle stone with a reflection factor of about 20 per cent. was situated in a district of medium brightness. Values of brightness of the surfaces were between 0.5 and 2.5 foot lamberts depending upon the colour of lamp used. These values correspond to the levels of illumination recommended by the author and shown in Table 3 of the paper. He thought that there was quite a field for the use of coloured, or even white, fluorescent lamps for supplementary lighting purposes.

Confusion often arose by thinking in terms of illumination rather than brightness. It was the visual effect which determined the success or failure of an installation and therefore if one thought in terms of lumens per sq. ft. it was necessary also to consider the conditions under which the installation operated, such as district brightness and the nature and condition of the building surfaces.

Referring to the lighting of gardens he recalled a conversation with an expert horticulturist who had been judging a chrysanthemum exhibition. One exhibitor gained prizes whilst another, who considered he gave equal attention to his exhibits, did not. It was discovered that the unsuccessful competitor spent long hours under floodlight tending his flowers and the view of the expert horticulturist was that these flowers had been given too much light.

MR. ACKERLEY, replying to the discussion, said he did not know, when he prepared the paper, that M. Chappat was going to speak on the question of large light sources used at a distance, but he was glad that M. Chappat had amplified the reference to this matter in the paper. It was an aspect about which more should be known, and M. Chappat was able to give information from experience.

He entirely agreed with Mr. Holmes on the importance of bringing out texture. Directional lighting was important in that respect. As to what was meant by "off-set distance," there was a definition in the draft revised B.S. glossary of illumination terms, and he referred Mr. Holmes to that. Commenting on luminous atmosphere around a floodlighted building, much could be done to control the amount of badly directed light which shone into the sky, but he did not see how it was possible to control the general luminous atmosphere around a building until the weather could be controlled.

On the question of the relative illumination values for working places and for spectacular floodlighting, he was quite prepared to agree that the values for the former should be put up, but there was one point which Mr. Holmes had overlooked, viz., that the floodlighting engineer might be trying to reveal a gargoyle on a building to an observer 200 or 300 ft. away, whereas a man working would usually be within

two or three feet of the illuminated area, and if allowance was made for distance the former would need more light.

The comments by Mr. Holmes on not drowning a building with light were interesting, and it was true that the criterion of a floodlighted job was not how much light was put on but how it was put on.

Mr. Ackerley agreed wholeheartedly with the remarks of Mr. Grenfell Baines, particularly in relation to the need for architects and lighting engineers to get together and co-operate. The only reason why Mr. Ackerley felt that floodlighting jobs were likely to be done largely by lighting engineers in the future, as they had been done in the past, was that he had begun to despair of architects, to use Mr. Grenfell Baines' words, " bestirring themselves to acquire a proper understanding of artificial lighting."

The points raised by Mr. Boydell with regard to equipment he would refer to the manufacturers. There was a difference between street lighting equipment and floodlighting equipment, in that the former did not have to withstand the same rough treatment, due to constant handling, as the latter. Floodlighting equipment must be robust, but if that could be combined with lightness and smallness so much the better.

As Mr. Boydell had suggested, there were many unimportant buildings which could be floodlit to advantage, and it was only because of lack of time and slides that he had shown only the more spectacular buildings, which had more prominent architectural features and, therefore, more easily illustrated the points he had wished to explain.

There should be a field for the use of fluorescent lamps for supplementary lighting, but their large area made the light from them difficult to control. Whether the lamp-makers could provide fluorescent lamps with appreciably higher brightnesses he did not know, but the point raised by Mr. Bellchambers was a good one.

He could not answer Mr. Boydell with regard to floodlighting the sea. The last time he tried it was in South Africa, about 20 years ago. It was successful, but it might be that the sea in South Africa was not so dirty as the sea Mr. Boydell had to deal with! If his memory was correct, it was necessary to mount the lamps at a very considerable height to get a good effect on surf.

It was true, as Mr. McCulloch had said, that the utilitarian side had not been dealt with to any extent in the paper, but it was not possible in the time available to do justice to the whole field. He had chosen to concentrate on spectacular floodlighting because the technique was not so familiar to lighting engineers. Industrial floodlighting technique was very similar to ordinary industrial lighting technique.

In reply to Dr. Walsh, he could only say that in a last-minute struggle to throw out a number of slides he had dispensed with slides of three small gardens which were extremely well floodlit. There might be something in the use of white light rather than coloured for gardens.

On the question of uniform distribution, mentioned by Mr. Smith, he said that if the light was spread evenly from a given angle, the architectural features of the building would provide the correct gradations of light and shade.

His experience with unventilated fittings had been satisfactory provided they were an engineering job. The unventilated fitting required a gasket nearly as good as that on a motor-car engine and, in his experience, fitted with a good gasket, the dirt did not get inside.

The floodlighting of Buckingham Palace was carried out when the forecourt was used for general access to and from the building, but it was not open to the public at the time.

He agreed with Mr. Waldram that for water in its natural state, white light was the best, and that colour on the Niagara Falls would be horrible. But in fountains he had seen some beautiful colour effects.

Finally, as regards floodlighting his garden, he was rather scared by the comment by Mr. Bellchambers of overworking the flowers.

Additions to List of Members

The following applicants have been duly elected by the Council to membership in the Society, and their names have been added to the list of members.

CORPORATE MEMBERS:—

Bromley, C. H. .....49, New Street, Oadby, LEICESTER.
Chapman, L. C. ..... "Alderley," Grange Road, Netley Abbey, HANTS.
Cowen, D. W. ..... c/o Sangamo-Weston, Ltd., 45, The Headrow, LEEDS.
Morris, S. F. ..... 15a, Stanton Road, West Wimbledon, S.W.20.
Ratcliffe, R. A. ..... 96, Dunbar Road, Wood Green, N.22.
Vivian-Jones, T. ..... 15, Llwyn Arosfa, Sketty, Swansea, GLAM.
Weston, C. P. ..... 16, Fosseway, Syston, Nr. LEICESTER.
Wimshurst, T. W. ..... 50, Talbot Road, SOUTH SHIELDS.

STUDENT MEMBER:—

Keen, P. G. .....49, Verdayne Avenue, Shirley, Nr. Croydon, SURREY.

Register of Lighting Engineers

The Council have accepted the following applications for inclusion on the Register of Lighting Engineers:—

C. P. Banham, R. H. Bell, C. W. Boagey, F. Hitchin, C. H. Logan, R. Pye, E. Turner, H. C. Vereker, W. J. Vine, J. A. Whittaker.

The Trotter-Paterson Memorial Lecture

The first Trotter-Paterson Memorial Lecture will be given at the Royal Institution, Albemarle-street, London, W.1. at 6 p.m. on Wednesday, January 17, 1951. The title of the lecture which is to be given by Dr. J. W. T. Walsh is "The Early Years of Illuminating Engineering in Great Britain."

Admission to the lecture will be by ticket only. Tickets may be obtained from the Secretary at 32, Victoria-street, London, S.W.1.

Since the publication of the previous list of subscriptions received for the Trotter-Paterson Memorial Fund the following subscriptions have been received and are gratefully acknowledged:—

	£ s. d.
Corporate Members: R. H. Bell, H. Hartley, J. M. Waldram, C. C. Smith, B. F. W. Besemer, H. D. Einhorn, Cecil Hughes, H. Hewitt, L. H. Hubble, H. Gough, E. J. Westaway, C. A. Morton, S. S. Beggs	9 16 0
Sustaining Members: British Electrical Development Association	5 5 0
Other Subscribers: V. Z. de Ferranti, The Society of Glass Technology, The Electrical Research Association, The Illuminating Engineering Societies of Australia	16 15 6
Total	£31 16 6

The total amount of the Fund is now £396 10s.

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